

15

25

30

12/3/01
WHD

14 or within a sample tube 34 by a vortex mixer 93 described in co-pending U. S. patent application Ser. No.: 09/703,139. The mixing member 254 may be caused to rapidly move by revolving an off-center magnetic field source 258 having sufficient magnetic strength at high speed in a generally circular pattern in close proximity to broth container 14 or sample tube 34. When the magnetic field source 258 is revolved as shown beneath broth container 14, the mixing member 254 is caused to move so as to minimize the distance separating the mixing member 254 from the magnetic field source 258. Revolution of the magnetic field source 258 causes the mixing member 254 to revolve within broth/sample solution 264 thereby generating a vortex-like mixing motion of broth/sample solution 264.

10 In the embodiment described, a disk 266 encases magnetic field source 258 as shown. In the exemplary embodiment shown in FIG. 13, the magnetic field source 258 comprises a permanent or semi-permanent magnet 258 and magnetic mixing member 254 is caused to revolve by rotating the permanent or semi-permanent magnet 258 at close proximity to the broth container 14 using a mixing motor 260 with a mixing motor shaft 262 having the disk 266 attached thereto. The term ferromagnetic is intended to mean a substance having a sufficiently high magnetic permeability to be positionally affected by an orbiting or rotating magnetic field.

15 *FIGS. 14A-14B are*
~~FIG. 14~~^{14A} is a perspective view of a closed elongate broth canister 24 having a generally rectangular cross-section (FIG. 14B) formed by a broth canister front wall 320, ID canister back wall 321 and two ID canister side walls 322, the front wall 320, back wall 321 and side walls 322 of essentially similar dimensions so that a squarely shaped interior is formed to house a plurality of broth containers 14 stacked one atop another. A top end portion 324 and a bottom end portion 326 close the ends of broth canister 24. Typically, broth canister 24 is formed as an indented sheet of plastic and is folded in half creating a external rib 325 extending the full length of broth canister 24 between broth canister back wall 321 and a side wall 322 (FIG. 14B). An opposed elongate broth canister seal flange 323 is created in a sealing operation and also extends the full length of broth canister 24 between broth canister back wall 321 and a side wall 322. A number of surface bumps 328 are formed in opposing pairs of finger pads 327 formed in top end portion 324 to facilitate handling of a broth canister 24 by an operator. FIG. 14B is a sectional view of broth canister 24 and best illustrates the broth canister seal flange 323, broth canister external rib 325 and internal ribs 328.

2/3/04
WKB

FIG. 14A-14B are

20

30

Beginning with FIG. 15A, an AST carrier 74 partially loaded with AST test arrays 12 and supported on AST array carrier bed 80B is seen positioned between AST carrier

12/3/04
HLS

transporter 76 and AST array dispenser 84. In these FIGs., two identical AST array carrier beds are identified as 80A and 80B for purposes of discussion. AST array carrier bed 80A is seen as being empty in FIG. 15A. As discussed earlier, AST array dispenser 84 is adapted to remove AST test arrays 12 from an AST canister 18 in the form of a singulated stream and to successively place the AST arrays 12 within a number of empty AST array slots 86 formed within an AST carrier 74 as the AST carrier 74 is advanced along a first direction on carried by AST array carrier bed 80B (arrow pointing "upwards" in FIG. 15A for purposes of illustration) as controlled by CPU 15. As indicated by the "upwards" direction of movement arrows, hereinafter called the "upwards direction", the empty AST carrier bed 80A is seen "ahead" of AST carrier 74 on the AST array carrier bed 80B that is partially loaded with AST test arrays 12. The purpose of FIGs. 15A-15M is to describe how high speed filling of AST test arrays 12 is accomplished as a result of the pipetting apparatus 46 operating in two opposed directions along the loci L defined by positions 46a-46e taken with AST test arrays 12 being filled with sample-inoculum at a plurality of positions also along loci L. For purposes of clarity, AST array carrier transport 78 is shown only once in dashed lines in FIG. 15B and its two directions of travel are as indicated by a double-ended arrow even though the AST array carrier transport 78 is in each of FIGs.

15A-15H and 15J-15M
15A-15M
A

FIG. 15B illustrates a subsequent stage of loading AST carrier 74 with AST arrays 12, a stage in particular whereat a fourth AST array 12 is being loaded onto AST array carrier 74; pipetting apparatus 46, having aspirated an amount of inoculum-broth solution from a broth container 14, is at position 46d and deposits a known amount of inoculum-broth solution into reservoir 134 of the first AST test array 12 loaded onto AST array carrier 74. As described before, pipetting apparatus 46 is controlled by CPU 15 between a third position, 46c, for aspirating a known amount of inoculum-broth solution from broth container 14 after the sample and broth are properly mixed together and a fourth position, 46d, for depositing a known amount of sample and broth into an AST test array 12. As will be described in conjunction with these FIGs. 15A-15H and 15J-15M, pipetting apparatus 46 "chases" AST array carrier 74 upwards or downwards as required so as to deposit inoculum-broth into all AST test arrays 12 carried by AST array carrier 74, eliminating the requirement that AST arrays 12 be filled at a stationary position(s). Because pipetting apparatus 46 "chases" AST array carrier 74 to deposit inoculum-broth into the AST test

17/3/64
1600
P 000000 000000

12/3/04
array filling process to continue without stopping by automatically proceeding to the AST
array 12 filling stages depicted by FIGs. 15A-15H and 15J-15N.
15A-M.

It should be understood that the feature of analyzer 10 in which a single pipetting
apparatus 46 operational in two opposed directions along a single linear path defined by
5 the loci of positions 46a-46d as defined above provides a degree of compactness in layout
in addition to minimizing the amount of time required in the AST array filling process.

FIG. 19 illustrates AST array dispenser 84 adapted to remove or eject AST test
arrays 12 from an AST canister 18 in the form of a singulated stream of AST test arrays
12 and to successively place each of the AST arrays 12 within an empty AST array slot 86
10 formed within an AST array carrier 74. AST array dispenser 84 comprises a pushrod 368
controlled by CPU 15 to displace an AST array 12 from an AST canister 18 and into
contact with an array alignment wall 360 and between the alignment wall 360 and an
array guide 362 to precisely position the lowermost AST test array 12 within an empty
parallel slot 86 in an AST array carrier 74. Array guide 362 is biased towards array
15 alignment wall 360 by array guide spring 364 to maintain alignment of an AST array 12
being moved from an AST canister 18 into an empty AST array slot 86 during the process
of loading AST arrays 12 onto a AST array carrier 74. An AST array lifter 369 is also
located below and between the alignment wall 360 and the array guide 362 to lift an AST
array 12 above the base 75 of carrier 74 (FIG. 17) as the AST array 12 is placed within an
20 empty AST array slot 86 in order to protect the layer of adhesive film along the bottom
surface 120 of AST array 12 previously mentioned.

FIG. 20 illustrates one of several alternate embodiments of a AST carrier transport
78 adapted to transport an empty AST carrier bed 80 or an AST carrier bed 80 having an
AST array carrier 74 totally filled with AST arrays 12 or partially loaded with AST arrays 12
25 during the loading process of FIG. 15. In one embodiment, AST carrier transport 78
comprises at least one AST carrier transport take up roller 380 which drives a belt 382 in
two directions along a linear path over upper operating plate 11 as illustrated in FIG. 15.
Both AST carrier beds 80 are fastened to the AST carrier transport belt 382 using pins
386. AST carrier transport belt 382 is moved along a linear path beneath sample
30 pipetting and delivery system 60 during which movement AST carriers 74 may be loaded
with AST arrays 12, and AST arrays 12 may be filled with a known amount of inoculum-